

AMENDMENTS TO THE SPECIFICATION:

Please amend the paragraphs beginning at page 1, line 9, and continuing to page 1, line 14, as follows:

The method comprises the ~~steps-acts~~ of;

- receiving analog signals on a number of m antenna array elements, and;
- producing a radiation diagram for the array from the values in the signals.

The ~~invention-technology~~ also refers to an antenna array system comprising means for performing the method.

Please amend the paragraph beginning at page 1, line 26, and continuing to page 2, line 7, as follows:

When using the antenna array applications there is a wish to obtain high resolution and accurate estimation of the direction-of-arrival of the target. In order to gain the best performance possible it is common knowledge that there has to be a trade off between the standard deviation σ (or variance σ^2) of the angle for detecting the target and the SNR (Signal to Noise Ratio). The higher the SNR the lower the standard deviation. The standard deviation is coupled to the probability of finding the target. The higher the standard deviation the lower the probability. The so-called “Cramér-Rao Lower Boundary (CRB)”, defines the theoretically best ratio between the SNR and the standard deviation σ for Additive White Gaussian Noise (AWGN) signals. It is the desire of every antenna user to have a system that performs as close as possible to the CRB. This is due to the fact that for a given SNR the lower the standard deviation the closer to the CRB, i.e. the better the accuracy of the direction-of-arrival estimation of a target.

Please amend the paragraph beginning at page 2, line 29, and continuing to page 2, line 32, as follows:

It is a desirable feature for an antenna system to have the ability to detect and estimate the direction of arrival of the target with a reasonable probability (reasonably low standard deviation). An optimum is thus sought for the trade ~~of-off~~ between low standard deviation and low SNR.

Please amend the paragraph beginning at page 4, line 11, and continuing to page 4, line 16, as follows:

It is an object of the ~~invention-technology~~ to diminish random errors regarding the resolving probability of the target when trying to narrow the main lobe, in order to get better estimation of the direction-of-arrival of a target. It is thus an object of the ~~invention-technology~~ to suppress the first grating lobes compared to the main lobe for the antenna array system, i.e. to increase the ratio between the main lobe and the closest (or first) grating lobes.

Please amend the caption on page 4, line 18 as follows:

DISCLOSURE OF INVENTIONBRIEF SUMMARY

Please amend the paragraphs beginning at page 4, line 19, and continuing to page 4, line 28, as follows:

The ~~invention-technology~~ intends to meet the above stated objects with a method for enhancing the ratio between the main lobe and grating lobes in an antenna array comprising a number of n antenna elements.

The method comprises the ~~steps-acts~~ of;

- receiving analog signals on a number of m antenna array elements, and;
- producing a radiation diagram for the array from the values in the digital signals.

The ~~invention-technology~~ is characterised in that the method comprises the ~~steps~~ acts of;

Please amend the paragraph beginning at page 6, line 17, and continuing to page 6, line 20, as follows:

The ~~invention-technology~~ is described as adding one radiation diagram to another, but it must be pointed out that this technique is equivalent to adding the vectors that generate the radiation diagrams. Hence, the gain $G(\theta)$ for one time is added to the gain $G(\theta)$ for another time at the corresponding angles.

Please amend the paragraph beginning at page 7, line 7, and continuing to page 7, line 12, as follows:

In a further ~~example~~ embodiment of the ~~invention~~ the sequence according to step b) is repeated x times until only the $m-x$ antenna elements on the outermost ends remain. x is an integer less than $m-2$ and greater than zero, denoting the number of removed or reduced antenna elements. Furthermore, step c) is then used for producing a sum radiation diagram by adding all the corresponding values of the radiation diagrams from all the x times t_x .

Please amend the paragraphs beginning at page 8, line 24, and continuing to page 8, line 28, as follows:

The ~~invention technology~~ also refers to an antenna array system comprising means for performing the above method.

The benefits of the ~~invention technology~~ above will become apparent when describing the ~~example~~ embodiments below.

Please amend the paragraph beginning at page 9, line 2, as follows:

The ~~invention technology~~ will now be described with reference to the drawings below.

Please amend the paragraph beginning at page 9, line 4, and continuing to page 9, line 5, as follows:

Fig. 1 shows an antenna array according to one ~~example~~ embodiment of the ~~invention~~, with a number of t_1 - t_4 configurations in time.

Please amend the paragraph beginning at page 10, line 7, and continuing to page 10, line 8, as follows:

Fig 11 diagrammatically shows a block diagram over the method according to the ~~invention~~ according to one ~~example~~ embodiment.

Please amend the captioned on page 10, line 10 as follows:

~~MODES FOR CARRYING OUT THE INVENTION~~DETAILED DESCRIPTION

Please amend the paragraph beginning at page 11, line 20, and continuing to page 11, line 26, as follows:

With “~~not~~ Not using” an antenna element or “removing” one antenna element, means that the signals from the antenna array 1 are reduced or blocked. This is advantageously done before the sampling of the signals, but may be carried out after the sampling. However, if the antenna elements 2 are to be reduced or blocked after the sampling, the system should require one sampling device per antenna element. In fig. 1 the reduced antenna elements 2 are depicted with a small x and denoted with 2’.

Please amend the paragraph beginning at page 16, line 15, and continuing to page 16, line 25, as follows:

It is evident from fig. 6 that the fourth distance 9 exceeds that of the first and second distance 8’, 8’’. This is because the ratio between the sum main lobe 10 and the sum of grating lobes 12 has enhanced compared to the ratio between the main lobe and the grating lobes according to the antenna array 1 configuration according to figs. 3 and 4. According to the described example embodiment of the invention, the summation of all, or some of, the radiation diagrams of the antenna configurations possible with an antenna array 1 according to fig. 1, yields the displacement of the points described in connection with fig. 7. This is due to the enhanced ratio between the sum main lobe 10 and the sum of grating lobes 12, compared to any one of the possible radiation diagrams taken alone.

Please amend the paragraph beginning at page 17, line 27, and continuing to page 17, line 31, as follows:

When reducing the array, according to the invention the width of the main lobe 5 will decrease, and the threshold will move closer to the CRB but with a demand for a higher SNR, than for the previous configuration of the array. This is depicted in fig. 7 where the second point P_2 has moved to the second point prime P_2' .

Please amend the paragraphs beginning at page 18, line 16, and continuing to page 19, line 16, as follows:

According to the ~~technology~~invention, the first point P_1 to the third point P_3 scenario described above may be displaced along the CRB in a direction with decreasing SNR, by enhancing the ratio between the main lobe 5 and grating lobes 7. By enhancing the ratio between the main lobe 5 and the grating lobes 7, the first point P_1 to the third point P_3 will be displaced to first point double prime P_1'' to the third point double prime P_3'' depicted in fig. 7. As can be seen in fig. 7, such a displacement allows a lower SNR before the threshold at the second point double prime P_2'' to the third point double prime P_3'' due to the appearance of the grating lobes 7.

According to the ~~invention~~technology, the ratio between the main lobe 5 and the closest grating lobes 7 is increased by adding the values from different configurations of the antenna array.

As a result of the displacement described above, it is possible to separate the antenna elements 2 to get a narrow main lobe and still enable the antenna system to operate at a low SNR. The ~~invention~~technology suppresses the grating lobes 7 at the same time as the directivity increases for the antenna array 1 system.

Fig. 8 shows a radiation diagram comprising all the radiation diagrams in figs. 2-5 overlapping each other together with the sum of the radiation diagrams (dotted line). Fig. 8 further shows the ~~benefits of the invention~~ described above.

Fig. 9 shows a two-dimensional antenna array 1 system according to one example ~~embodiment of the invention~~, with a number of configurations in time t_1 , t_m , and t_n . The antenna array 1 system comprises five rows along an Y-axis. Each row comprises ten antenna elements 2 along a Z-axis. The antenna elements 2 are reduced or switched off in the same manner as described in fig. 1. ~~The invention technology~~ described above is thus possible to use on two-dimensional antenna arrays.

Please amend the paragraph beginning at page 20, line 6, and continuing to page 20, line 8, as follows:

Fig 11 shows a block diagram over the method ~~according to the invention~~ according to one example embodiment. The blocks in fig. 11 depict a number of means suitable for performing the method.